Before the
Federal Communications Commission
Washington, DC 20554

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| In the Matter of | ) | |
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| Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands | ) | WT Docket No. 04-356 |
| | ) | |
| Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands | ) | WT Docket No. 02-353 |

To: The Commission

# REPLY COMMENTS


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## SUMMARY

The results of CTIA's independent lab tests show that H block PCS operations pose a significant risk of harmful interference to tens of millions of wireless customers' phones. Given the breadth of the effect of such interference, the Commission must adopt stringent limits to protect existing PCS users from H block interference if the band is used for PCS-like mobile telephony.

Perhaps the most significant H block interference effect is PCS receiver overload. The duplexers, or filters, in PCS handsets are designed to take advantage of the 20 MHz separation between the base and mobile bands. Reducing that separation dramatically by putting the H block in the middle makes receiver overload possible, because the filters have not been designed to reject strong signals from nearby handsets transmitting in the H block.

The Commission should ensure that services relied upon by the nation's 170 million wireless subscribers, most of whom use devices that operate in the PCS band and will be vulnerable to H block interference, are not adversely affected. Without adequate protection, customers will experience lost calls, reduced data rates, and other harmful interference from nearby H block devices. It is very common for numerous people to be using wireless phones within a few meters of each other, but significant separation is needed between H block and PCS devices to prevent interference. The interference risk is amplified when multiple users are in close proximity indoors, due to weaker signals from the base stations. Improving the filtering in wireless devices is no answer: it would require wholesale replacement of all existing PCS devices, while increasing their size, cost, and battery drain and reducing their performance. There is no justification for negatively affecting customers' satisfaction with PCS in these ways, and no reason why PCS carriers and their customers should bear the cost of a new entrant's incompatible use of nearby spectrum. Thus, the Commission should not shift the adverse technical and economic impact of H Block operations due to out-of-band emissions ("OOBE") and receiver overload to existing PCS carriers and their millions of customers.

An H block device can interfere with many nearby PCS devices even if it is not being used to make a call, and in a crowded area there may be multiple H block devices. As a result, the use of the H block for PCS-like operations poses competitive fairness issues. H block operators will not encounter interference from PCS, but PCS operations will receive interference from H block usage. Consumers will not know what is causing the interference, and may blame their own carriers. Moreover, it is unlikely that devices will be capable of operating in the H block and also in the existing PCS blocks.

A better use of the H block may be for fixed or air-ground uses, where interference can be avoided or eliminated more efficiently. If the Commission nevertheless authorizes an H block PCS-like service, it must adopt significant constraints. H block usage presents new interference challenges, unlike those addressed in today's PCS systems. The duplexers in today's devices were not designed to operate with the separation between bands reduced by use of the H block, and the laws of physics present significant design limitations on developing duplexers to address the problem.

Nextel attempted to show that H block operations pose no serious interference threat, but it made numerous serious technical errors, such as mischaracterizing the level of emissions from PCS base stations, failing to account for the effect of antenna directional patterns, and not prop-

erly computing line loss. The net effect of all these and other serious errors is to vitiate Nextel's technical analysis altogether.

CTIA's test results show that both of the Commission's proposed OOBE limits (−60 and −66 dBm/MHz) may be inadequate to prevent serious interference to nearby PCS handsets, while the industry standard −76 dBm/MHz limit will largely prevent such interference. Cingular urges the Commission to adopt a rule that is based on accepted industry standards and is technology neutral. With respect to spectrum below the mobile portion of the G block, the standard (43 + 10 log(P)) dB OOBE limit should be sufficient to protect PCS base stations from H block mobile units. The standard limit should also apply to the J block. It is not necessary to impose more stringent OOBE limits on other PCS bands; the limits are needed for H block only because it has been demonstrated to cause interference, and in any event changes to the rules for current PCS licensees are beyond the scope of this proceeding, because the Commission has given no notice of any such proposed rule amendments.

The 23 dBm handset power limit discussed in the *NPRM* is an order of magnitude too high; an H block handset at a comparable power level in the CTIA tests caused an 80% frame error rate in test phones one meter away. Based on analysis of the test data, a power limit of 13 dBm is needed to protect the bulk of tested handsets against receiver overload. This limit should apply across the entire H block, rather than having varying power limits at different frequencies within the H block. A single limit is warranted both due to variability of performance with temperature variations, and to promote technological neutrality, because varying power limits by frequency will disfavor wideband technologies, such as W-CDMA (UMTS).

If the H block is used for PCS-like services, the Commission should ensure that H block licensees are subject to the same general regulatory constraints that apply to PCS licensees, whether the rules for H block are located in Part 27 or Part 24. The Commission should also use relatively small regional areas, comparable to BTAs, for initial licensing of the H block (as well as the J block) if it decides on PCS-like service.

Accordingly, the Commission should designate the H block for services other than terrestrial land mobile service, such as fixed services or air-ground. To the extent it permits PCS-like mobile service in the H block, it should impose rigorous OOBE and mobile power limits on its use to prevent harmful mobile-to-mobile interference to existing PCS operations.

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To: The Commission

**REPLY COMMENTS**

Cingular Wireless LLC ("Cingular") hereby submits its reply comments in response to the Commission's *NPRM* concerning implementation of advanced wireless services in the H and J frequency blocks.[1]

## I. INTRODUCTION

In the *AWS Sixth Report and Order*[2] allocating spectrum for the H and J frequency blocks, the Commission acknowledged that serious interference issues are posed by using the H block (1915-1920 MHz paired with 1995-2000 MHz), in particular, given its location with respect to the existing broadband PCS bands.[3] The Commission deferred to the instant proceeding a determination of how to minimize the interference caused by H block operations to incumbent PCS services. To address the issues raised in the *NPRM*, Cingular participated with other PCS

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1 *Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands, Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands,* WT Dockets 04-356 & 02-353, *Notice of Proposed Rulemaking,* FCC 04-218 (Sept. 24, 2004) (*NPRM*), *summarized,* 69 Fed. Reg. 63489 (Nov. 2, 2004).

2 *Advanced Wireless Services,* ET Docket No. 00-258, *Sixth Report and Order, Third Memorandum Opinion and Order and Fifth Memorandum Opinion and Order*, FCC 04-219 (Sept. 22, 2004) (*AWS Sixth Report and Order*).

3 *See id.* at ¶¶ 18-28.

licensees in assisting CTIA–The Wireless Association™ in evaluating its tests of the impact of H block operations on existing PCS handsets.[4] Based on the results of those tests, Cingular is extremely concerned that H block PCS operations will pose significant interference risks to the tens of millions of wireless customers' phones that are already in use today as well as to new subscribers that are being added on a daily basis.

Given the broad-scale effects that such interference would have, the Commission must adopt stringent limits to protect existing PCS users from H block interference and should consider limiting use of the H block frequencies to non PCS-like services. The Commission should not shift the adverse technical and economic impact of H Block operations due to out-of-band emissions ("OOBE") and receiver overload to existing PCS carriers and their millions of customers. As such, Cingular recommends that: (i) power levels for H block devices be set at 13 dBm across the entire block; and (ii) the Commission adopt a technology-neutral rule based on industry standards for out-of-band emission limits at 1930 MHz.

## II. H BLOCK MOBILES WILL CAUSE UNACCEPTABLE INTERFERENCE TO EXISTING PCS HANDSETS

### A. Interference Sources

The Commission noted in its *AWS Sixth Report and Order* that the 10 MHz separation between the H block and PCS A block raises the real possibility of two forms of interference to

[4] The tests were conducted by the Rutgers Wireless Information Network Laboratory ("Winlab") and PCTEST Engineering Laboratory, Inc. ("PCTest"). The test results were submitted with the comments filed by CTIA. *See* CTIA Comments (filed Dec. 8, 2004) at Attachments B ("Winlab Report") and C ("PCTest Report"). CTIA also submitted a declaration from its engineering consultant, Dr. Charles L. Jackson. *See id.* at Attachment A ("Jackson Declaration").

PCS operations: (i) OOBE and (ii) receiver overload interference.[5] In addition, Sprint/Verizon Wireless note that intermodulation interference is a particular problem for CDMA handsets.[6]

OOBE are natural consequences of any radio system; emissions beyond the desired frequency band can be attenuated but not completely eliminated. Appropriate technical restrictions on OOBE can prevent significant interference from occurring on frequencies outside the H block, particularly in the PCS mobile receive bands.

In the case of the H block, receiver overload interference is a matter of even greater concern than OOBE. Receiver overload interference occurs when a receiver becomes unable to receive a signal at its intended frequency without degradation beyond a specified limit, due to the presence of a signal at a nearby frequency. Overload has not been a significant issue in PCS historically because the filters built into today's PCS handsets are designed to work with the 20 MHz separation between the base and mobile transmit bands, thereby minimizing overload concerns.[7] The Commission's proposal to reduce the size of that separation distance—without the ability to correspondingly modify the millions of phones in use—thus risks increasing the overload problem and dramatically changes the interference environment for PCS users.

The filter is the key element in PCS handsets that provides overload protection.[8] The filters in today's PCS handset receivers are designed to pass the upper PCS band (1930-1990 MHz), used for base-to-mobile transmissions, and have been designed to reject signals at the upper edge of the lower PCS band (1850-1910 MHz), used for mobile-to-base transmissions. They

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5 *See AWS Sixth Report and Order* at ¶¶ 21-27.

6 *See* Sprint/Verizon Wireless Comments at 13-15 (filed December 8, 2004).

7 *See* Sprint/Verizon Wireless Comments at 4; T-Mobile Comments at 6.

8 GSM/EDGE systems do not transmit and receive at the same time and, thus, do not need an actual duplex filter as does CDMA. However, these systems do rely on receive filters to provide adequate isolation from interference.

have not, however, been designed to reject strong signals from nearby handset transmitters in the H block.[9] The H block is located in the middle of what today is the transition region for the duplexer filters — *i.e.,* the filters accept signals at the bottom of the A block at 1930 MHz from an A block base station to an A block mobile — but the filter roll-off was not designed to reject strong signals from nearby H block mobile transmitters, which would operate only 10 MHz below the A block base station transmitter. This problem is also related to the width of the overall passband for PCS. Since the desired passband for the mobile receiver is 60 MHz wide (1930-1990 MHz), it is difficult to achieve an extremely sharp filter response in the relatively narrow transition region from 1910-1930 MHz. This is made even more difficult by the reduction of the transition region from 20 MHz to 10 MHz with the inclusion of the G and H blocks. As a result, H block mobile transmitters can interfere with other PCS mobile receivers through the mechanisms of desensitization and intermodulation. This is particularly a problem for technologies such as UMTS that have been developed (and specifications defined) to operate with a 20 MHz duplex separation.

Sprint and Nokia have shown that PCS handsets are susceptible to overload interference caused by the inability of the PCS handsets' receive filters to attenuate the primary emission in the H block sufficiently, particularly those handsets employing SAW filters, the most common type of filter used today.[10] In short, the duplexers in tens of millions of PCS handsets in use and being sold today do not sufficiently filter out the anticipated signals in the H block.

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[9] This is a one-way problem in that H block receivers will not have the same issue. H block mobile receivers will be tuned to the 1995-2000 MHz band, which is located far from the bands used for transmissions from PCS mobiles.

[10] *See* Letter from Luisa L. Lancetti, Sprint, to Marlene H. Dortch, FCC, ET Docket 00-258, dated September 1, 2004, Attachment ("H Block Overload Test Results") at 8, 12.

Cingular participated in the evaluation by CTIA of the results of independent laboratory tests conducted by PCTest and Winlab for CTIA concerning the interference effects of H block operations in proximity to mobile phones operating in the PCS A through F blocks.[11]

The most critical conclusions to be drawn from the tests are:

- Receiver overload interference will be a serious issue for GSM, CDMA, and UMTS PCS handsets that are located close to an H block handset, if the FCC's proposed 23 dBm (200 mW) power limit for H block is adopted.

- Intermodulation interference is a serious issue for CDMA and UMTS PCS handsets, and is most serious at elevated temperatures, if the FCC's proposed 23 dBm (200 mW) power limit for H block handsets is adopted. (GSM handsets are not subject to this type of intermodulation interference from H block operations because they do not transmit and receive during the same block of time.)

- Due to the limited availability of UMTS handsets, further testing is needed with respect to UMTS. However, the results are expected to be similar to those found with CDMA.

- H block mobiles' compliance with the industry standard CDMA OOBE limit of −76 dBm/MHz would largely prevent OOBE interference at a separation of 1 meter from PCS phones.

Significantly, the test results showed that the characteristics of the duplexers in PCS phones vary dramatically over their normal operating temperature range[12]. As a result of the response of duplexer performance to temperature shifts, it appears that PCS phones may be subject to overload interference from devices transmitting in any part of the H block, not only from transmissions in the highest H block channel, which is closest to the PCS handset's A block receive frequencies.

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[11] The full results of the tests were submitted by CTIA with its comments. *See* note 4 above.

[12] *See also ex parte* presentation filed by William Mueller, Agilent Technologies, Docket ET 00-258, at 6, 9 (filed August 19, 2004) ("Agilent *ex parte*"); Nextel Comments at 35-36 n.68 (filed December 8, 2004).

### B. Impacts on Consumers Will be Severe

Consumers depend on high quality mobile service for personal, commercial, and emergency communications. Billions of dollars have been invested with the expectation that such systems will be able to satisfy consumer and business demand for high-quality, dependable services. The Commission must take care not to adversely affect service quality, consumers' satisfaction or the safety and reliability of mobile services.

Based on the results of the tests conducted by the independent labs, it is clear that H block interference will be a real threat to existing PCS phones. There are currently more than 170 million wireless subscribers in the U.S., a majority of whose devices operate in the PCS band either exclusively or in addition to the cellular band. These devices were designed when there was no need to protect such portables from transmissions in the H block. The threat to these legacy handsets and their users is particularly severe because the customer experiencing interference will not know where the interference is coming from and will likely attribute the interference to his or her handset or the serving carrier, even though neither the phone manufacturer nor the carrier is responsible.

Such interference can be expected to occur often. Situations in which an H block device is in close proximity to a PCS phone will happen more frequently than some have theorized in this proceeding, as discussed below. When interference occurs, subscribers will experience lost calls, distorted audio, the inability to make or receive calls, the inability to determine location, and reduced data rates. Moreover, the widespread use of H block phones will affect carriers as well, by diminishing their capacity and the breadth of their coverage. It should also be noted that interference from H block devices will affect existing PCS mobiles operating in all of the existing PCS blocks, A through F. However, the interference scenarios are entirely one-way, because

existing PCS mobiles will not interfere with H block mobile receivers due to the greater separation between the PCS mobiles' transmit frequencies and the H block mobiles' receive passband.

Addressing the problem through improved filtering in PCS handsets would require replacement of all existing phones that use the PCS band. This would require more complex filtering that would significantly increase the size and cost of wireless phones. It would also increase drain on the battery as the phone would have to raise its power as it attempts to overcome the interference. Furthermore, the insertion loss within the filter passband would also be increased due to the need to provide increased selectivity and the net effect would be reduced performance for all PCS blocks. The result would be larger, more expensive phones with less talk/standby time. All of these factors are very significant to consumers and carriers, and there is no justification for negatively affecting consumers' satisfaction with PCS in these ways. Moreover, PCS licensees and their customers should not be required, in effect, to bear the cost of a new entrant's operation and interference. This would be contrary to the Commission's long-standing policy that the new entrant must bear the cost burden of preventing harmful interference.

### C. Probability of Interference Occurring Is High and Will Unfairly Affect Existing Carriers

As Agilent and Motorola have acknowledged, devices operating on the H block as well as the PCS A through G blocks are not currently technically feasible nor likely to be feasible in the foreseeable future.[13] Because H block operations could subject PCS users to seriously degraded service quality, while H block operators are unlikely to encounter interference from PCS operations, the use of the H block for PCS-like operations poses serious issues of competitive fairness, unless appropriate power and OOBE limits are adopted.

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[13] Agilent *ex parte* at 2, 11; Motorola Comments at 8.

The test results show that at the power levels being contemplated by the FCC, harmful interference *will* occur to PCS customers using their phones near an H block device. The tests employed phones typical of those being used by tens of millions of PCS customers, so the interference levels reported in the tests are likely to occur whenever PCS customers use their phones in the vicinity of an H block device. The H block device need not be actively engaged in a call to interfere, because all commercial wireless phones engage in periodic background communications with base stations, such as to report their availability to receive a call. A single H block device could cause interference — evidenced by dropped calls, failure of incoming calls to complete, or deterioration of call quality to an unacceptable level — not only to a single PCS phone, but to all PCS phones within several meters, depending on the maximum power level that the FCC authorizes. In a crowded area, the interference would likely be multiplied by the presence of multiple H block devices.

This interference will be one-way — the interference will not be from the PCS A-F blocks to the H block device, it will only be from the H block device to the existing PCS A-F blocks. This interference will occur when users are in close proximity. People who are physically near each other often share their wireless experience with each other, particularly when experiencing a lack of service or dropped calls. As a result, wireless users will notice when one carrier's phone is working and another carrier's is not. Also, customers using their phones in close proximity are often times business customers and high usage customers. Customers using PCS A-F block phones will experience the interference, while those with H block devices will not, and customers are likely to hold their service providers responsible when they encounter interference. As a result, customers of PCS A-F block carriers will tend to believe that their ser-

vice is inferior and that the service of the H block provider is more reliable, not knowing that the interference comes from the H block device of their neighbor.

It is very common for people in close proximity to be using their phones at the same time. Places this can happen include, but are by no means limited to:

- In a car, bus or train;
- In an airport waiting room, a hotel lobby, or a meeting room;
- In the vicinity of schools and colleges;
- In the area surrounding a movie theater, ball game, concert, or other event;
- In the stands at an outdoor event such as a ball game or concert; and
- Emergency events.

The bottom line is that close proximity among wireless users is commonplace, but significant separation between H block and A-F block devices is necessary to avoid harmful interference.[14] In such situations, a pronounced difference in wireless service quality due to H block interference will quickly become evident. The effects would be especially noticeable when these conditions exist in rural areas, because in such areas the PCS phones would be receiving relatively weak signals from a distant cell, while the H block devices would be transmitting at full power to reach a distant cell.[15] For similar reasons, H block interference would be pronounced when multiple users are in close proximity indoors, due to the weaker signals caused by in-building coverage attenuation (*e.g.,* in building, elevators, parking garages, shopping malls).

[14] Sprint and Verizon Wireless, for example, state that the 23 dBm power limit proposed by the Commission would mean that "the H Block mobile device must not come within 26 feet (or 8 meters) of the PCS handset," and that the worst-case handset in the tests "demonstrated IM interference at a received H Block mobile device power level of –40 dBm, which occurs at 41 feet (or 12.5 meters) of an H Block mobile device operating at 23 dBm." Sprint/Verizon Wireless Comments at 12.

[15] In many cases, the cells are likely to be collocated, which would maximize the interference in areas where signal quality is marginal.

This situation has nothing to do with the near-far problem discussed at length in Nextel's comments.[16] In this type of situation, it is likely that the signals from both the standard PCS base station and the H block base station are relatively weak

This interference could have a serious, competitively skewed effect on PCS carriers' coverage and capacity. Technical studies in the record show that even relatively low levels of interference can have disastrous effects on the service received by PCS customers. For example, in rural areas, just 1 dB of degradation would require a 17% increase in the number of cellsites to maintain the previous level of service, and in an urban environment, a 1 dB link loss would cause a 25% reduction in GSM system capacity and a 2 dB link loss would reduce capacity by 40%.[17]

## III. THE H BLOCK SHOULD NOT BE USED FOR PCS-LIKE SERVICES OR SHOULD BE SUBJECT TO STRINGENT REQUIREMENTS TO MITIGATE INTERFERENCE

Based on the results of the testing and the operational and competitive implications of H block interference, Cingular agrees with Sprint/VZW that a better use of the spectrum may be for fixed or air-ground services.[18] For fixed services, interference can be identified and eliminated by best practice guidelines on a case by case basis. For air-ground use, interference to spectrally adjacent PCS operations can be avoided by designating the lower band of the H block for base stations and the upper H block for airborne mobiles.[19] In neither of these cases would H block

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16 *See* note 22 below.

17 Comments of AT&T Wireless, ET Docket 03-237, at 17-18 (filed April 5, 2004).

18 *See* Sprint/Verizon Wireless comments at 2, 5, 9, 15.

19 This would completely avoid the mobile-to-mobile interference issues, because PCS mobiles would no longer be attempting to receive base station transmissions on frequencies subject to interference from close-by H block transmitters. The lower H band would be used by base stations, which would be few in number and spatially distant from both PCS mobiles and base station receivers. The upper H band, on the other hand, would be used only by mobiles while aloft, and thus thousands of feet distant from terrestrial PCS handsets attempting to receive signals from base stations on the upper PCS bands.

usage pose a significant interference threat to PCS operations provided that appropriate rules are adopted and best practices followed.

### A. Significant Technical Limitations Are Required To Enable H Block PCS Operations

If the Commission nevertheless permits the use of the H block for a land mobile service similar to PCS, significant constraints must be adopted, as described herein. First, however, Cingular disagrees with Nextel's characterization that none of the four possible interference scenarios are new or unusual and its characterization that existing systems cause more OOBE and overload interference than H block could ever be expected to produce.[20] The close proximity from the H block uplink to the PCS downlink is new and unusual, because the duplexers in use in mobile devices today were not designed with this close separation in mind, and some question whether they can be so designed. As Agilent has explained, this close proximity poses significant design limitations due to the fundamental laws of physics within their state-of-the-art duplexers.[21] Second, the test results show that the primary interference concern is mobile-to-mobile interference, not a near-far problem as Nextel tries, inaccurately, to imply.[22]

Furthermore, Nextel's technical analysis of typical wireless networks and its accompanying conclusions are incorrect. For example, Nextel incorrectly describes the levels of emissions from PCS base stations and assumes that there have been no instances of OOBE interference to

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[20] *See* Nextel Comments at 8-9, 12-13, 23-30.

[21] *See* Agilent *ex parte* at 2-11.

[22] *See* Nextel Comments at 14-18. Near-far issues arise when a mobile station is far away from its own serving base station system but close to the victim base station. Under these circumstances, transmissions from the mobile can result in the victim base station having reduced coverage and/or capacity or the creation of dead spots or zones. This problem is well understood and operators deploy known best practice guidelines, such as collocation, to avoid interference of this nature. The principal concern regarding the proposed usage of the H block is not the near-far problem, but direct mobile-to-mobile interference. Moreover, near-far interference is a concern to operators and does happen in the real world, a fact that is more of a problem for systems using wider bandwidths (cdma2000 and UMTS). Nextel is probably not as familiar with this problem at first hand, because its system operates with 25 kHz bandwidth.

existing PCS systems.[23] Nextel correctly points out that PCS base stations typically operate at higher power levels than PCS handsets, but ignores the fact that the OOBE limits on both are the same, namely –13 dBm/MHz.[24] Nextel's misunderstanding of PCS operational realities vitiates its analysis altogether, as in its failure to account for directional antenna patterns' effect on OOBE,[25] and it does not even account properly for line loss.[26] Nextel's analysis of noise rise is

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[23] *See* Nextel Comments at 14.

[24] *See id.*

[25] For example, Nextel failed to account for the directional pattern of the antenna of the D block base station in its analysis at page 15 of its comments, leading it to seriously incorrect conclusions (it makes the same errors at page 24). For a PCS base station with an antenna at 20m, the signals to mobiles that are close to the tower would be at angles that are outside of the main beam of the antenna pattern — at 50m, 23.5° below the main beam; at 100m, 11.5° below; and at 200m, 5.7° below. Given a typical antenna pattern for PCS systems (peak gain 17 dBi), the OOBE levels predicted by Nextel at the victim receiver should be reduced by 10 to 20 dB (or more). Furthermore, because the –13 dBm/MHz OOBE limit is measured at the output of the base station, there is no accounting for the additional attenuation in the signal combiners and/or any additional filters or duplexers that are typically used at PCS cell sites. These combiner and filter losses can be 6-10 dB, or more, depending on the cell site. As shown in this table, the levels of OOBE seen "on street level" from PCS base stations are much lower than Nextel projected:

| OOBE Power (dBm/MHz) | Cable and other loss (dB) | Angle φ (degrees) | Antenna Gain (dBi) | Distance (m) | Free Space Path loss (dB) | Victim Antenna Gain (dBi) | Interference Level (dBi) |
|---|---|---|---|---|---|---|---|
| -13 | 2 dB + combiner loss (CL) + filter loss (FL) | 23.5 | +2 | 50 | 72 | -3 | -88 - CL - FL |
| | | 11.5 | +3 | 100 | 78 | | -93 - CL - FL |
| | | 5.7 | +7 | 200 | 84 | | -95 - CL - FL |

If this were not the case then there would be severe problems in the vicinity of every cell site — which is clearly not true for PCS systems. This also demonstrates that while OOBE may be a problem is some cases, it does not mask or eliminate the potential interference problems caused by transmissions from H block mobile devices into existing PCS mobile receivers.

The foregoing analysis is based on an assumed antenna height for the PCS base station of 20m. However, depending on the geography of the area many PCS cell sites use antennas as high as 30 to 60 meters (100 to 200 ft.) which would decrease the OOBE levels even more than what is shown above due to the additional propagation loss and also the antenna pattern effects. Furthermore, it should also be noted that the results predicted by Nextel as well as those shown above rely on free space propagation (loss exponent = 2) and in many cases the signals will be reduced even further due to multipath propagation (loss exponent = 3 to 4) and blockage due to buildings or vegetation.

[26] Nextel's analysis at pages 15 and 24 of its Comments significantly underestimated the amount of loss in the components in a typical PCS base station cell site. As Nextel has indicated, the actual loss in the transmission line used to connect the transmitter to the antenna may be 2-3 dB. However, in addition to this the duplex filter adds 0.5 dB, the diplexer connection through the LNA system adds 0.6 dB, the diplexer at the base of the tower adds 0.5 dB and the necessary jumper cables add 1.0 dB. Thus the filter and connection losses can be approximated as 2.6 dB. In addition to this, most systems will use either a 2-way or 4-way signal combiner that adds an additional loss of 3.3 dB to 6.6 dB. With these additional losses included in the table above, it is clear that in some cases there may be

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also incorrect, with the net result being that Nextel has significantly underestimated the impact of additional interference. In short, Nextel has calculated the amount of additional interference but did not calculate the total net interference level (*i.e.,* the rise in the overall noise plus interference level).

### 1. Boundary Limits (Adjacent Co-Channel Licensees)

The current Part 24 rules prescribe a maximum base station signal level at the boundary between licensees, namely 47 dBμV/m, unless a different boundary level is established by agreement.[27] Given that mobile signals are the source of the unique interference concerns regarding H block operations, and no major issues appear to exist regarding base station signal levels, Cingular supports applying the existing PCS boundary rule to land mobile H block operations.

### 2. OOBE

The Commission acknowledges that strict limits are needed to protect PCS handset reception in the 1930-1990 MHz band from OOBE due to H block device transmissions in the 1915-1920 MHz band. The *NPRM* asks whether a −60 dBm/MHz OOBE limit will provide adequate protection, assuming a 2 meter separation, or, alternatively, whether a −66 dBm/MHz OOBE limit will be adequate protection at a 1 meter separation.[28]

In general, the –13dBm/MHz limit should apply at the top of the H block (1920 MHz), and an additional limit should be adopted to limit the emissions from H block devices at 1930

(footnote continued)
problems with receiver performance in the very close vicinity of PCS cell sites. However, most cell sites do not exhibit this type of problem and this in no way reduces the effects of mobile to mobile interference which is of significant concern to PCS operators.

[27] *See* 47 C.F.R. § 24.236.

[28] *NPRM* at ¶ 91.

MHz. As the new entrant, an H block licensee must ensure that its mobile devices do not interfere with existing PCS operations. Accordingly, it would be reasonable to adopt a technology neutral rule requiring H block devices to meet accepted industry standards such as the –76 dBm/MHz limit for CDMA as suggested by Sprint/Verizon and CTIA.

With respect to the spectrum below the 1915-1920 MHz mobile portion of the G block, the Commission tentatively concluded that the standard OOBE limit of (43 + 10 log(P)) dB should be sufficient to provide protection.[29] Cingular agrees that the (43 + 10 log(P)) dB limit should be sufficient to protect base stations operating in the adjacent bands from H block mobiles. Likewise, Cingular agrees that the standard OOBE limit should apply to the lower end of the J block (2020-2025 MHz).[30]

Cingular does not agree with Nextel's contention that whatever OOBE limits are imposed on the H block should also be imposed on other PCS bands.[31] While the Commission in the NPRM and those commenting in this proceeding recommend H block limits more stringent than the FCC rules for PCS, the H block devices should be required to meet this, because they are the new entrant and have been demonstrated to cause interference. Any potential rule changes concerning the technical rules applicable to the existing PCS bands are beyond the scope of this proceeding, because the Commission has neither proposed, nor given notice of, any change in the Part 24 OOBE rules governing the existing PCS bands. The Administrative Procedure Act

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29 *NPRM* at ¶ 87.

30 *See NPRM* at ¶¶ 98-100.

31 *See* Nextel Comments at 21.

would require a new notice of proposed rulemaking in order to consider whether to follow Nextel's suggestion.[32]

In any event, there is a valid reason for imposing a stricter OOBE limit on H block devices than on those operating in the current PCS bands: the OOBE limits on existing PCS mobiles (43 + 10 log(P)) apply at the edge of the transmit band, and it is generally assumed that emissions are reduced significantly in the frequency range 1910-1930 MHz. However, in the case of H block devices, the frequency separation is significantly reduced and it is not unreasonable to adopt an OOBE limit for H block devices at 1930 MHz, as the Commission has proposed. Furthermore, Nextel's comments regarding churn[33] mean nothing to those many customers who are satisfied with their phone and may not decide to upgrade their phone.

### 3. Handset Power Limits

The *NPRM* "suggests," based on an analysis contained in the *AWS Sixth Report and Order*, that limiting the peak EIRP of H block mobiles to 200 mW (23 dBm) "should be sufficient to adequately address concerns about overload interference to nearby PCS handsets," but invites comment and data concerning this issue.[34] However, the test data generated by CTIA's contractors demonstrate that an H block device operated at a comparable level (166 mW, or 22.2 dBm, which is less than 1/10 the maximum power permitted for a PCS mobile under Part 24) would cause an unacceptable 80 % or higher frame error rate in test phones one meter away which would result in dropped calls.[35] The test results indicate unambiguously that the H block power limits tentatively selected by the Commission are at least an order of magnitude too high.

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32 *See* 5 U.S.C. § 553.

33 *See* Nextel Comments at 33-38.

34 *NPRM* at ¶ 107, n.220, *citing AWS Sixth Report and Order* at ¶ 27.

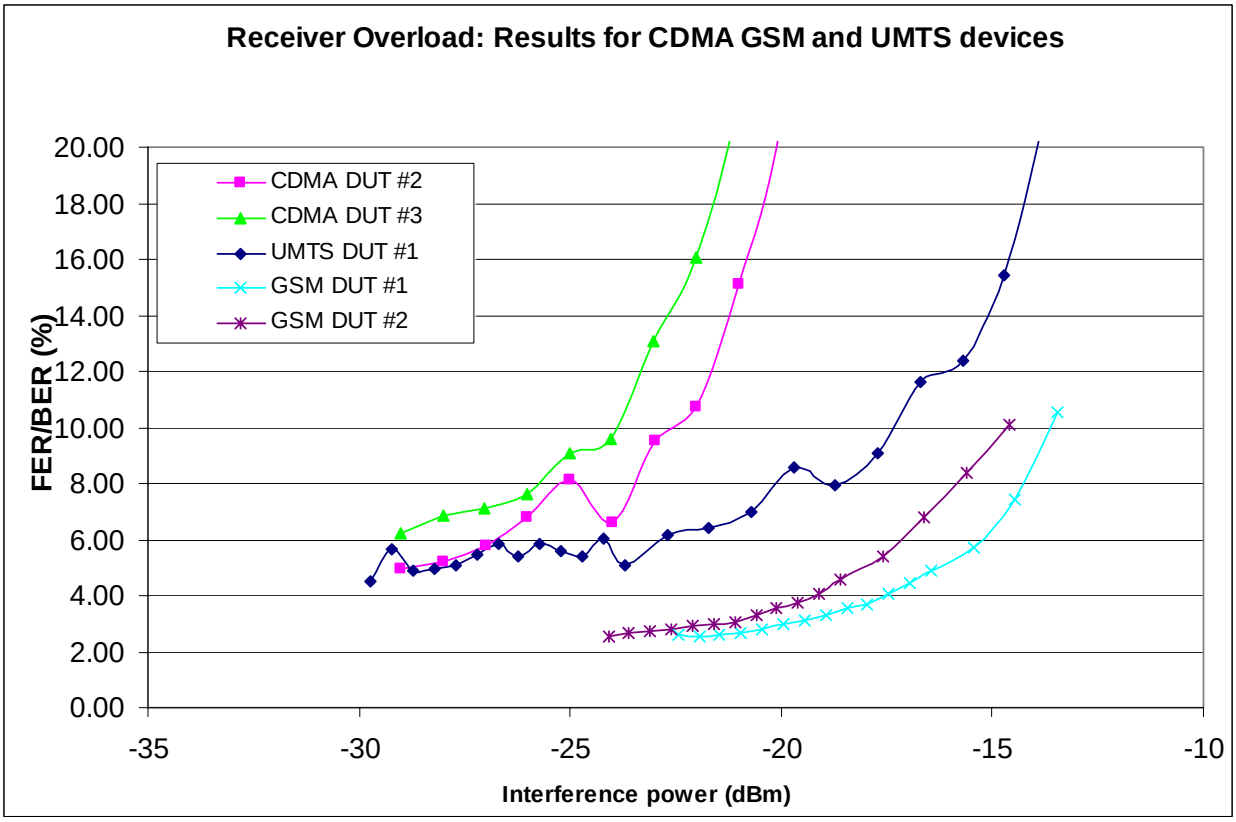
35 *See* Winlab Report, Tables 15, 16.

The analysis of H block mobile power limits is based on the results of the receiver overload and intermodulation tests. The parameters used to calculate power limit of the H block mobiles are as follows:

- Harmful interference signal level that increases the relevant error rate by 1% (Acceptable Bit Error Rate ("BER") for GSM, Acceptable Frame Error Rate ("FER") for CDMA and UMTS).
- Free space loss between the two devices: The formula for free space loss yields an attenuation of 38 dB for H block signals with a separation of 1 meter.
- Impact of the mobile antenna gain (0 dB) and body loss (3 dB).[36]

Receiver overload data for GSM, UMTS and CDMA devices referenced from the graph below show that a protection level of –28 dBm would protect the bulk of the tested handsets against receiver overload. A protection level of –28 dBm would lead to the power limit of +13 dBm for H block handsets.

[36] *See* Harri Holma and Antti Toskala, WCDMA FOR UMTS (3rd Edition, John Wiley and Sons, 2004) at 187.




Source: Data from Winlab Report, Tables 23, 34, 51, 59, 67
(BER values apply to GSM devices; FER values apply to UMTS and CDMA devices)

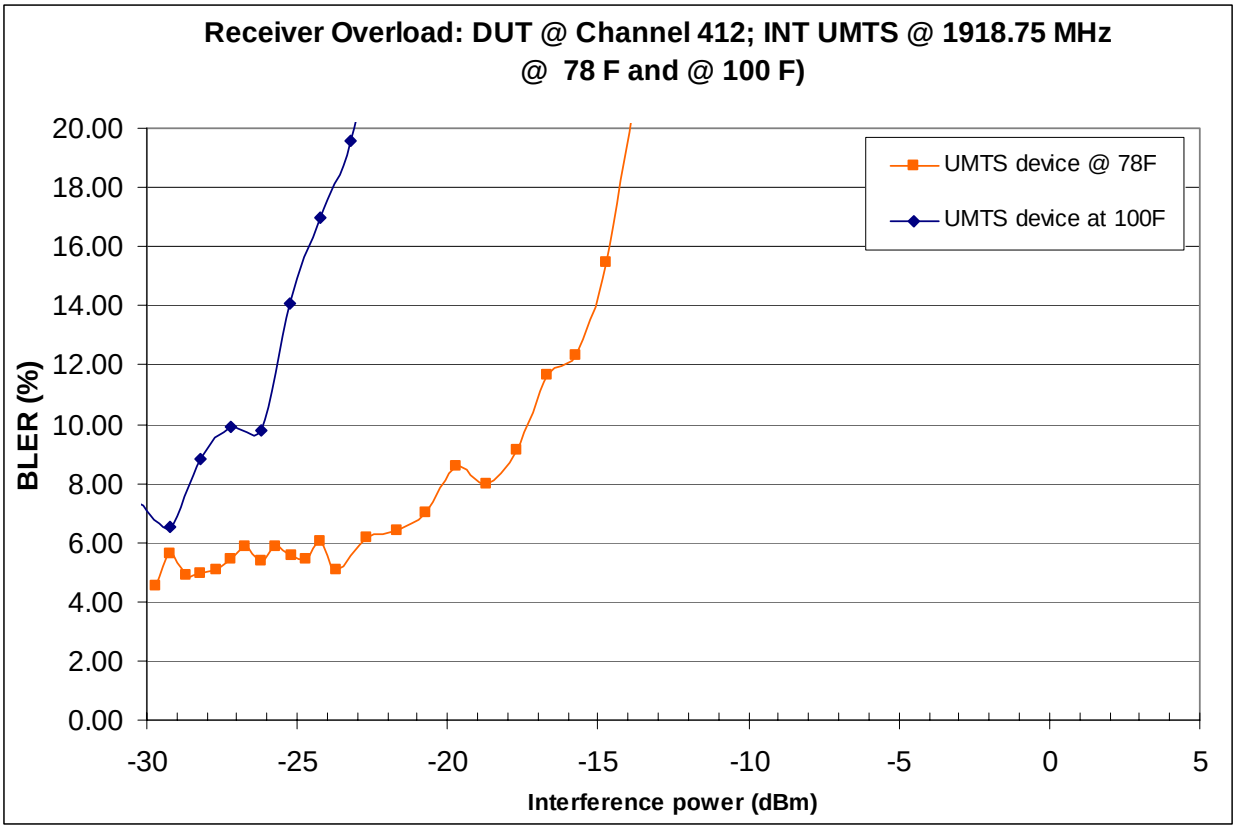
It would be theoretically possible to adopt power limits that vary over the width of the H block, with higher power limits at the lower frequencies, which have greater separation from the lower end of the upper A block, and with the power limit being reduced with increasing frequency. Some commenters have proposed such approaches.[37] The Commission, however, should adopt the more conservative approach of imposing a single power limit across the entire H block, a limit that provides adequate protection to PCS operations regardless of which part of the H block is used.

The use of a single conservative power limit is warranted for two reasons. First, the test data show that duplexers' performance varies significantly with temperature. The graph below

[37] CTIA Comments at 13, 21; Sprint/Verizon Comments at 12-13.

derived from the Winlab report demonstrate that there is nearly 10 dB of degradation in duplexer performance when the temperature is increased from 78°F to 100°F. PCS mobiles are regularly exposed to such temperature variations, especially in summer and in sunny climates. Agilent has shown that both temperature variability and product-by-product variations are critical factors in ensuring that a duplexer will perform adequately.[38] The second reason for employing a single uniform limit is technological neutrality. Power limits that vary by frequency across the H block will favor technologies employing narrower bandwidths, such as cdma2000, and disfavor wide-band technologies, such as W-CDMA (UMTS).

Effect of temperature on duplexer performance




Source: Data from Winlab Report, Table 67

[38] *See* Agilent *ex parte* at 6; *see also id.* at 9.

While some may argue that limiting the power of the device will limit the functionality of the overall service, if the power limits for devices are clearly identified in the service rules, potential bidders will know this and will be able to adjust their bids accordingly. As a result, the spectrum will likely go to entities with innovative applications that are able to maximize the utility of spectrum that is limited in terms of device power.

As discussed above, the Commission should impose a uniform H block power limit to the entire band, as opposed to CTIA's proposal to apply three separate power limits to various segments of the H block. Because Cingular may deploy UMTS systems and because of the variation in duplexer performance for UMTS devices, the filter skirt could shift to the middle H block and higher power in the middle and lower H block segments could equate to stronger interference.

### B. Similar Rules Are Required for Similar Services

To the extent the Commission restricts the H block to either air-ground or fixed services, the regulatory framework of Part 27, with a new rule subpart devoted to H block, appears to be most appropriate. If, however, the Commission chooses to permit H block licensees to offer PCS-like land mobile services (subject to appropriate interference rules), it should ensure that H block licensees offering such services are subject to the same general regulatory constraints as those that apply to their competitors, such as the obligation to provide telecommunications relay service, E911, number portability, and roaming. This can be accomplished either by creating a new subpart of Part 27 containing the special interference rules and cross-references to the Part 24 and Part 20 rules governing PCS operators, or by creating a new subpart of Part 24 containing the special interference rules needed for H block operations.

### C. Geographic Licensing

The appropriate geographical licensing area for H block depends on the regulatory approach that the Commission selects. If it believes the primary use of this spectrum will be for air-ground service, it should adopt a national or large-regional licensing scheme that will minimize the inefficiencies of smaller license areas, given that any base station would likely be serving an area up to a hundred or more miles in radius. If the Commission believes fixed services are likely to be the primary use of this spectrum, it should adopt a relatively small-regional licensing scheme, comparable to cellular market areas in size, that would allow the licensee to freely deploy fixed transmission facilities with limited range across a metropolitan area or similar-sized rural area.

If, on the other hand, the Commission finds that the principal use of the H block will be to provide a land mobile service similar to PCS, as it has with respect to the adjacent G block, it should utilize licensing areas comparable to the smaller areas used for licensing PCS, namely Basic Trading Areas or BTAs; this approach should also be followed with respect to the J block. Ideally, the Commission should use the actual BTAs as its licensing areas, in order to facilitate the use of the H and J blocks to complement the PCS A-F blocks, if it can either accomplish this within the framework of its agreement with Rand-McNally or can negotiate an extended agreement. Alternatively, the Commission should explore whether it can set forth its own designated, numbered H block licensing areas composed of the same counties as the BTAs used in previous PCS proceedings, without infringing on Rand-McNally's trademarks or copyrights.[39]

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[39] For example, a listing of counties comprising an area for which previous licenses were auctioned and for which a given license will be offered at auction would appear to be non-copyrightable. *See Feist v. Rural Telephone Service, Inc.,* 499 U.S. 340, 344-45 (1972) ("[F]acts are not copyrightable . . . . The most fundamental axiom of copyright law is that 'no author may copyright his ideas or the facts which he narrates.'"), *quoting Harper & Row, Publishers, Inc. v. Nation Enterprises,* 471 U.S. 539, 556 (1985). Moreover, "collections of facts are not copyright-

(continued on next page)

If the Commission finds that it is unable to use the same licensing areas as in previous PCS proceedings for legal reasons, it could use other similarly-sized small geographic areas, such as the Economic Areas ("EAs") designated by the Department of Commerce, for its licensing of the H and J blocks. While it will be problematic for a handset to be built covering the A-H blocks (therefore, potentially limiting involvement in the auction by current PCS carriers), if a PCS licensee were to determine that this was feasible, smaller blocks on a BTA basis would allow that carrier to bid on spectrum for footprint or capacity needs. The use of small geographic building blocks, such as BTAs or EAs, would provide opportunity for smaller carriers and new entrants as well as allow existing carriers to aggregate their spectrum holding depending upon the individual need and size of the operation. Dividing the spectrum at the smallest geographic level comparable to other licenses affords the most flexible and efficient way for operators to augment their spectrum needs and providing rural carriers access to additional spectrum for mobile and fixed services. Licensing spectrum for PCS-like services on a nationwide basis should be rejected, because it will prevent the efficient use of spectrum where it is needed.

(footnote continued)

able *per se*. . . . Facts are never original, so the compilation author can claim originality, if at all, only in the way the facts are presented." 499 U.S. at 357-58. Thus, a mere listing of facts, such as the telephone directory's listing of names, addresses, and telephone numbers in *Feist,* in an unoriginal way is not copyrightable. *Id.* at 363. Likewise, it is questionable whether a mere listing of the counties within an area previously used for PCS licensing is copyrightable. The Commission should determine whether it is able to publish a listing of such PCS license areas and their respective county components, designated by arbitrary Commission-assigned market numbers, instead of the BTA designators developed by Rand-McNally, without infringing on Rand-McNally's intellectual property.

## CONCLUSION

For the reasons stated, the Commission should designate the H block of advanced wireless service spectrum for services other than terrestrial land mobile service, such as fixed services or air-ground. To the extent it permits this spectrum to be used for terrestrial land mobile service, it should impose rigorous OOBE and mobile power limits on H block licensees' use to prevent harmful mobile-to-mobile interference to existing PCS operations.

Respectfully submitted,

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